

Patent Application
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Section II. REMARKS

Claims 1-14, 16-19, 21-33, 38-45 and 50-55 are presently pending in the application.

Amendment of Claims 10, 24 and 29 to Overcome Objection Thereto Under 37 CFR 1.75(c)

In response to the Examiner's objection to claims 10, 24 and 29 as failing to limit the subject matter of a previous claim, claims 10, 24 and 29 have been amended to overcome such objection.

Claim 10 has been amended to (i) remove the term "about" from the recitals of numerical ranges of concentration of components therein, (ii) add the word "particles" after silica in line 2 of the claim, and (iii) specify the lower limit of iminodiacetic acid concentration as 0.1%, consistent with claim 1. As thus amended, the recitals in claim 10 are limiting of components and ranges specified in claim 1, from which claim 10 depends.

Thus, claim 10 as amended herein recites:

"10. The method of claim 1 wherein said second slurry comprises 1-10% colloidal silica particles, 0.1-1% potassium iodate, 0-5 % concentrated inorganic acid and 0.1-2% iminodiacetic acid."

This claim further restricts claim 1, in compliance with 37 CFR 1.75(c), since:

Claim 1 requires the second slurry to have:	Claim 10 requires:
1-10% silica particles	1-10% colloidal silica particles, meaning that all silica particles of claim 1 must be present as colloidal silica particles, rather than being of some other type of silica particles
0.1-1.5 wt. % oxidizing agent	0.1-1% potassium iodate, meaning that both the concentration and the type of oxidizing agent are more restrictively specified than in claim 1
having a pH in a range of from about 2 to about 5	0-5 % concentrated inorganic acid, which is a pH adjustment agent for achieving the pH range of about 2 to about 5 that is recited in claim 1; inorganic acid also accelerates copper removal rates – the recital of the concentrated inorganic acid thereby further specifies the subject matter of claim

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0.1-2 wt. % carboxylic acid	0.1-2% iminodiacetic acid, which further restricts the carboxylic acid recited in claim 1 to a specific dicarboxylic acid species

Based on the foregoing, claim 10 as herein amended complies with the requirement of 37 CFR 1.75(c), in further restricting the subject matter of claim 1.

Claim 24 has been amended to recite that a carboxylic acid is present in the first chemical mechanical polishing slurry.

Thus, claim 24 as amended recites:

24. The method of claim 22 wherein a carboxylic acid is present in said first chemical mechanical polishing slurry.

This claim further restricts claim 1, from which claim 22 is dependent, in compliance with 37 CFR 1.75(c), since claim 1 recites that the second chemical mechanical polishing slurry includes carboxylic acid, but does not require that the first chemical mechanical polishing slurry include any carboxylic acid. Claim 24 further restricts the first chemical mechanical polishing slurry to include carboxylic acid.

In like manner, claim 29 has been amended to recite that a carboxylic acid is present in the first chemical mechanical polishing slurry.

Thus, claim 29 as amended recites:

29. The method of claim 23 wherein a carboxylic acid is present in said first chemical mechanical polishing slurry.

This claim further restricts claim 1, from which claim 23 is dependent, in compliance with 37 CFR 1.75(c), since claim 1 recites that the second chemical mechanical polishing slurry includes carboxylic acid, but does not require that the first chemical mechanical polishing slurry include any carboxylic acid. Claim 29 further restricts the first chemical mechanical polishing slurry to include carboxylic acid.

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In view of the foregoing, all claims 10, 24 and 29 as herein amended are now in compliance with 37 CFR 1.75(c). It therefore is requested that the objection to such claims be withdrawn in view of the amendments made herein.

Response to the §112, First Paragraph Rejection Based on Recital of "Carboxylic Acid" in Claim 1

In the September 24, 2004 Office Action, the Examiner rejected pending claims 1-14, 16-19, 21-33, 38-45 and 50-55 under 35 U.S.C. §112, first paragraph, on the basis of the contentions that:

- (1) Claim 1 does not have support in the specification for "generic carboxylic acid;" and
- (2) Claim 1 is based on a non-enabling disclosure in respect of "first and second chemistries of chemical mechanical polishing slurries."

Such rejection under §112, first paragraph is traversed, and reconsideration of claims 1-14, 16-19, 21-33, 38-45 and 50-55 is requested, in light of the following remarks.

Since the rejection of claims under §112, first paragraph is based on alleged deficiencies of claim 1 in respect of enablement, and since all remaining claims depend directly or indirectly from claim 1, it is instructive to review the language of claim 1:

1. A method for chemical mechanical polishing copper, barrier material and dielectric material, the method which comprises the steps of:
 - a) providing a first chemical mechanical polishing slurry comprising (i) 1-10 wt. % silica particles, (ii) 1-12 wt. % oxidizing agent, and (iii) 0-2 wt. % corrosion inhibitor and cleaning agent, wherein said first slurry has a higher removal rate on copper relative to a lower removal rate on said barrier material;
 - b) chemical mechanical polishing a semiconductor wafer surface with said first slurry;
 - c) providing a second chemical mechanical polishing slurry comprising (i) 1-10 wt. % silica particles, (ii) 0.1-1.5 wt. % oxidizing agent, and (iii) 0.1-2 wt. % **carboxylic acid**, having a pH in a range from about 2 to about 5, wherein the amount of (ii) is not more than the amount of (iii), and wherein said second slurry has a higher removal rate on said barrier material relative to a lower removal rate on said dielectric material and an intermediate removal rate on copper; and
 - d) chemical mechanical polishing said semiconductor wafer surface with said second slurry.

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The examiner has rejected claim 1 on §112, first paragraph grounds based on his contention that

“the specification, while enabling for iminodiacetic acid, does not reasonably provide enablement for carboxylic acid (which includes hundreds and thousands of compounds). The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make the invention commensurate in scope with these claims. Applicant does not have support in the specification for ‘generic carboxylic acid’ except iminodiacetic acid. Furthermore, all examples in applicant’s specification are only enabling for the specifically disclosed ‘iminodiacetic acid’.”

This statement, however, is incorrect. The Examiner’s attention is directed to the instant specification at page 10, line 18 to page 11, line 1 in respect of the carboxylic acid component of the second chemical mechanical polishing slurry:

“The corrosion inhibitor and cleaning agent for the first and second slurries should be a carboxylic acid. More specifically, the carboxylic acid may be chosen from the group of glycine, oxalic acid, malonic acid, succinic acid and nitrilotriacetic acid. Alternatively, the carboxylic acid may be a dicarboxylic acid that preferentially has a nitrogen containing functional group. In the most preferred form, the corrosion inhibitor and cleaning agent for the first and second slurries is iminodiacetic acid.”

Thus, the disclosure of the application clearly identifies carboxylic acid as a general category ingredient for use in the second chemical mechanical polishing slurry, and in connection with such general applicability of carboxylic acids discloses various illustrative species (glycine, oxalic acid, malonic acid, succinic acid, nitrilotriacetic acid, dicarboxylic acid with N-containing functional group, iminodiacetic acid).

Consistent with such disclosure, applicant has properly demarcated the second chemical mechanical polishing slurry as containing, *inter alia*, 0.1-2 wt. % carboxylic acid. There is no §112, first paragraph infirmity in such recital.

The first paragraph of 35 USC §112 requires nothing more than objective enablement, whether achieved by use of illustrative examples or by broad terminology. *In re Marzocchi et al.*, 439 F2d 1220, 169 USPQ 367 (CCPA 1971). An assertion by the examiner that the enabling disclosure is not commensurate in scope with the protection sought must be supported by evidence of reasoning substantiating the doubts so

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expressed. *In re Dinh-Nguyen et al.*, 492 F2d 816, 181 USPQ 46 (CCPA 1974); *In re Bowen*, 492 F2d 859, 181 USPQ 48 (CCPA 1974); *In re Armbruster*, 512 F2d 676, 185 USPQ 152 (CCPA 1975). Here the examiner has made no showing, presented no chemical rationale, and given no reason why he believes that one of skill in the art could not make the second CMP slurry with carboxylic acid based on the disclosure in the instant application.

There is therefore no tenable basis for the rejection of claim 1 and claims dependent thereunder, merely because applicants' claims require a "carboxylic acid." One of skill in the art is fully capable, as a matter of general knowledge, reference materials availability and chemical supplier catalog perusal, of identifying carboxylic acid compounds and of employing same in the second chemical mechanical polishing slurry in the practice of the claimed method of applicants' invention, without undue effort.

The applicants' disclosure has no inherent deficiency, and provides clear guidance to the skilled person in the art that carboxylic acids are categorically useful in the second slurry composition. Further, the applicant has given identification of illustrative species of variant structure (compare the structure of glycine to that of iminodiacetic acid or to that of nitrilotriacetic acid, for instance) as evidencing the general applicability of carboxylic acids per se in the second slurry composition.

This is all that is required to support a recital of "carboxylic acid."

The same factual circumstance was addressed in *In re Grier*, 342 F2d 120, 144 USPQ 654 (CCPA 1965), in which the court reversed the examiner's §112 enablement rejection. The examiner's rejection was based on use of the term "carboxylic acid" in the appellant's claims. The court reversed the examiner, finding that the appellant's use of the term "carboxylic acid" was "not unduly broad" where it was supported by specific illustrative examples and "almost any carboxylic acid will work."

The examiner herein is respectfully requested to reconsider, and on reconsideration to withdraw, the rejection of claim 1 on the stated grounds.

It also is noted that in connection with his rejection of claim 1 for use of "carboxylic acid," the examiner has stated that

"Accordingly, all dependent claims 1-14, 16-19, 21-33, 38-45, and 50-55 are rejected." (page 2, lines 15-16 of the September 24, 2004 Office Action).

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Thus (apart from the fact that the examiner has mis-identified claim 1 as a dependent claim in the above statement of rejection), the examiner has rejected all pending dependent claims (2-14, 16-19, 21-33, 38-45, and 50-55) simply by virtue of their dependence from "carboxylic acid"-reciting claim 1, and has ignored the fact that:

- claims 25 and 30 recite that "said carboxylic acid is chosen from the group consisting of: glycine, oxalic acid, malonic acid, succinic acid and nitrilotriacetic acid" and
- claims 28 and 33 recite that "said dicarboxylic acid is iminodiacetic acid."

The untenability of the examiner's rejection based on recital of "carboxylic acid" is further emphasized by the blanket rejection of claims that recite specific carboxylic acid species, which includes even the claims (28 and 33) that recite a single species (viz., "iminodiacetic acid") that the examiner has expressly conceded to be enabled ("all examples in applicant's specification are ... enabling for the specifically disclosed 'iminodiacetic acid'" – page 2, lines 13-14 of the September 24, 2004 Office Action).

Therefore, by the examiner's own admission, the carboxylic acid species that is recited in claims 28 and 33 is fully enabled, yet such claims have been rejected as part of a blanket rejection of all pending claims as lacking enablement! This merely underscores the lack of proper basis for the blanket rejection, in light of the clear guidance in the applicants' specification that carboxylic acids are categorically useful in the second slurry composition of applicants' invention as evidenced by the disclosed illustrative carboxylic acid species of variant structure.

For all these reasons, claims 1-14, 16-19, 21-23, 38-45 and 50-55 are in compliance with the requirements of 35 USC §112, first paragraph, as regards the recital of carboxylic acid in claim 1, and the further recital of various carboxylic acid species in claims dependent thereunder.

The examiner is respectfully requested to reconsider, and upon reconsideration to withdraw, the §112, first paragraph rejection of claims 1-14, 16-19, 21-23, 38-45 and 50-55 on the stated grounds.

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§112, First Paragraph Rejection of Claim 1 Based on First and Second Chemistries

In the September 24, 2004 Office Action, claim 1 was rejected under 35 USC §112, first paragraph, as based on disclosure that the examiner has characterized as non-enabling, in respect of "first and second chemistries."

The examiner's statement of rejection on such basis is unclear, as seeming to say that essential features are not included in claim 1, and that the non-included features are non-enabled by the disclosure:

"Claim 1 is rejected under 35 U.S.C. 112, first paragraph, as based on a disclosure which is not enabling. The first and second chemistries of chemical mechanical polishing slurries are critical or essential to the practice of the invention, but not included in the claim(s) [sic - only one claim (claim 1) has been rejected, and the reference to "claim(s)" appears to be a typographical error] is not enabled by the disclosure [emphasis in original text]. See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976). (FP07-3301). Claims 1 [sic - as mentioned, there is only one rejected claim (claim 1) and the reference to "claims" appears to be a typographical error] does not set forth first and second chemistries of chemical mechanical polishing slurries involved in the method/process, which is [sic - the antecedent appears to be "chemistries," which requires a plural verb "are" to avoid confusion] critical to produce removal rates of barrier material, dielectric material and copper and relationship among them [sic - the tangled syntax makes it difficult to understand what "them" refers to, whether the first and second chemistries, removal rates of barrier, dielectric and Cu materials, or removed materials themselves]. Therefore, the scope of protection provided by the claim is not adequately enabled by the description of the invention provided in the specification of the application. The scope of the claim goes beyond the scope justified by the description of the invention provided in the specification and drawings."

Although the lack of clarity in the statement of rejection makes it difficult to assess the intended basis for such rejection, it appears that (i) the examiner has taken the position that first and second "chemistries" of the claimed CMP method are absent from claim 1, (ii) that such first and second "chemistries" are additionally beyond the scope of the description in the application and (iii) the scope of claim 1 is beyond the scope of the description in the application.

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Such position is contradictory, since reduced to its essence, it amounts to the assertion that something is missing from the claim, but the claim contains something that is missing from the specification, and the scope of the claim is more than the scope of the specification.

In fact, if by "chemistries" (a term that is nowhere used in any of the pending claims) the examiner is intending to mean the compositions of the first and second chemical mechanical polishing slurries, then the examiner's statement that "[T]he first and second chemistries of chemical mechanical polishing slurries are ... not included in the claim(s)" is incorrect.

In fact, claim 1 clearly sets forth the chemical components of the first chemical mechanical polishing slurry as including

"(i) 1-10 wt. % silica particles, (ii) 1-12 wt. % oxidizing agent, and (iii) 0-2 wt. % corrosion inhibitor and cleaning agent,"

and claim 1 clearly sets forth the chemical components of the second chemical mechanical polishing slurry as including

"(i) 1-10 wt. % silica particles, (ii) 0.1-1.5 wt. % oxidizing agent, and (iii) 0.1-2 wt. % carboxylic acid, having a pH in a range from about 2 to about 5, wherein the amount of (ii) is not more than the amount of (iii)."

Thus, the examiner's statement that "chemistries" are "not included in the claim(s)" is wholly at odds with the clear and unambiguous recitals of the specific components of the slurry, and amounts of each of such specific components in the slurry, for each of the first and second chemical mechanical polishing slurries specified in the claim.

The examiner has cited *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976) as the precedential authority for the examiner's determination that claim 1 is non-enabled, but an intensive review of the Mayhew decision fails to provide any supportive basis for such determination.

The court in *Mayhew* considered two fact-specific issues of enablement.

The first issue concerned Mayhew's claims directed to a continuous-strip method for producing coated steel strip, in which the examiner held the claims to be non-enabled for failure to recite a cooling zone or its location. The court sustained the rejection of such claims on the basis that the applicant had disclosed

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to use a cooling zone at the exit side of an alloying bath to achieve superior alloying, specifically teaching that the "strip ... and bath ... are raised in temperature above what is ordinarily considered optimum coating temperatures..[T]his is practicable because of special cooling apparatus, specially located."

Thus, in *Mayhew*, the applicant had disclosed that his superior inventive result was achievable only because of "special cooling apparatus" that was "specially located." The court held that the examiner therefore was fully justified in calling for the inclusion of a cooling zone of specified location:

"We therefore conclude that claims which fail to recite the use of a cooling zone, specially located, are not supported by an enabling disclosure." *In re Mayhew*, at 358.

In the present application, there is no "special ingredient" that has been omitted from claim 1 and the examiner has not called for the inclusion of any "special ingredient" or "special proportion" or any other specific "special thing."

Instead, the examiner has simply advanced the position, without any basis, reason or support, that unspecified "critical or essential" chemistries are not present in claim, in disregard of the fact that claim 1 sets forth essential ingredients and the amounts of each of those essential ingredients, for each of applicants' first and second chemical mechanical polishing slurry compositions, consistent with the enabling disclosure of the instant application.

The examiner's attention is directed to the instant specification at page 10, lines 12-16:

"Turning now to the composition of the CMP slurry, generally the first and second slurries comprise silica particles, an oxidizing agent, a corrosion inhibitor, and a cleaning agent." (emphasis added)

This is precisely what is recited in claim 1:

"1. A method ... which comprises the steps of:

- a) providing a first chemical mechanical polishing slurry comprising (i) 1-10 wt. % silica particles, (ii) 1-12 wt. % oxidizing agent, and (iii) 0-2 wt. % corrosion inhibitor and cleaning agent,
- c) providing a second chemical mechanical polishing slurry comprising (i) 1-10 wt. % silica particles, (ii) 0.1-1.5 wt. % oxidizing agent, and (iii) 0.1-2 wt. % carboxylic acid, having a pH

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in a range from about 2 to about 5, wherein the amount of (ii) is not more than the amount of (iii) ...”

with the instant specification disclosing in the paragraph bridging pages 10 and 11 thereof, in reference to preferred ingredients (oxidizing agents, corrosion inhibitors and cleaning agents) of the first and second slurries that “[T]he corrosion inhibitor and cleaning agent ... should be a carboxylic acid.”

Claim 1 therefore is fully consistent with and supported by the description of the specification, and claim 1 correspondingly sets forth the invention in a manner that is fully enabled and in compliance with the requirements of 35 USC §112, first paragraph.

Returning to a consideration of *In re Mayhew*, the second issue faced by the court concerned Mayhew’s claims directed to the continuous-strip method for producing coated steel strip, in which the examiner held the claims to be non-enabled, even though they specified a cooling zone and its location, on the basis that such claims did not specify a temperature range in the zone or its function.

The court summarily reversed the examiner on this second issue, on the basis of the following analysis:

“Reading the claims, as they must be read, in the light of the specification, we think that the general function of the cooling zone is clear from the other recitations of the claims and that selection of the temperature of the zone would be within the ability of one of ordinary skill in the art attempting to follow the teaching of the specification. It is also apparent that the temperature of the cooling zone would have to be regulated to meet varying conditions, such as the temperature of the main body of the bath, the thickness of the strip, the speed of its movement through the bath, etc. ...

We think it self-evident that the function of the cooling zone is simply to cool the strip. The reasons for cooling and the resultant advantages, which make clear what the proper degree of cooling will be in any given situation, are explained in the specification. ...

We are therefore of the opinion that the specification is enabling with respect to the claims of this group ... we feel that a statement of function would be superfluous. The language employed in a claim must always be analyzed in light of the specification, which here adequately teaches the function of the zone of cooled spelter.”

In re Mayhew, at 359.

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Thus, the court declined to import additional limitations into the claims, and properly placed the emphasis on whether the specification was objectively enabling so that one of ordinary skill in the art could determine "temperature of the cooling zone" and "the proper degree of cooling ... in any given situation."

There is nothing in this second issue analysis of *Mayhew* that is in any way indicative of any deficiency in applicants' claim 1 or the description of applicants' claimed invention in the specification.

Simply stated, applicants have appropriately set forth the compositional ingredients and amounts of same in the recitals in claim 1 of the first and second chemical mechanical polishing slurries. One of skill in the art reading the specification is fully apprised of the invention, and of the manner of making and using the first and second slurries to carry out the claimed method of chemical mechanical polishing of a semiconductor wafer surface, so as to be fully able to practice such method.

Nothing more is required by 35 USC §112, first paragraph for enablement.

Claim 1 and the instant specification fully comply with such statutory provision.

The examiner therefore is respectfully requested to reconsider, and on reconsideration to withdraw, the rejection of claim 1 on the stated grounds.

CONCLUSION

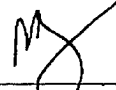
Based on all of the foregoing, the pending claims 1-14, 16-19, 21-33, 38-45 and 50-55 as herein amended are now in form and condition for allowance. The Examiner is respectfully requested to issue a Notice of Allowance for this application.

No fee is necessitated by the amendments made hereinabove in claims 10, 24 and 29. Nonetheless, authorization hereby is given to charge any fees necessary for entry of this Amendment to Deposit Account 08-3284 of Intellectual Property/Technology Law.

If any issues remain outstanding, incident to the formal allowance of the application, the Examiner is requested to contact the undersigned attorney at (919) 419-9350 to discuss same, in order that this application may be allowed and passed to issue at an early date.

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Respectfully submitted,



Steven J. Hultquist
Reg. No. 28,021
Attorney for Applicant

INTELLECTUAL PROPERTY/
TECHNOLOGY LAW
P.O. Box 14329
Research Triangle Park, NC 27709
Telephone: (919) 419-9350
Fax: (919) 419-9354
Attorney Ref: 2771-451 DIV (7486)